

## **DROSERA ARCTURI IN TASMANIA AND A COMPARISON WITH *DROSERA REGIA***

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### *Drosera arcturi* in the wild

The Alpine Sundew *Drosera arcturi* is endemic to alpine, subalpine, and cool humid coastal areas of south eastern Australia and New Zealand (Erickson, 1968). It is an interesting, rhizomatous, winter deciduous perennial with a history stretching back over fifty million years (Macphail, 1988). The Tasmanian populations include significantly larger plants than those which occur elsewhere in its range. From my observations this form has many similarities with *D. regia*, from South Africa. I compare the two in this paper.

*Drosera arcturi* is typically a small growing species with three to five erect, linear leaves 2 to 5 cm long that are produced over a four month period (October—February). Mature plants produce a single erect scape up to 5 cm tall which carries a single white-petalled flower. The flower is open in January. Around Mt. Kosciusko, New South Wales and near the summits of Mt. Bogong and Mt. Baw Baw, Victoria, the sundews grow in colonies in damp peat, often growing with mosses and low herbs (including *Utricularia monanthos*) at the boggy beginnings of small streams and beside lakes. The typical form of the species is often difficult to find in the wild due to its small stature. In all areas this species experiences prolonged freezing conditions, often moderated by lingering snow cover.

In 1991 and 1997 I undertook fieldwork in Tasmania which included observing *Drosera arcturi* in the wild and studying herbarium specimens. The Tasmanian plants are unusual in that they include more robust plants with leaves up to 25 cm long. The flowering parts are twice the size of the typical plants. There are up to three flowers per scape.

In Tasmania *Drosera arcturi* is found from near sea-level (in the southwest portion of the island) to over 1400 m elevation on peaks of the central plateau. At low elevations it grows in buttongrass sedge swamps, and at high elevations it grows on lake edges and low alpine to subalpine herb fields, often in the company of large cushion plants. Several plants grow in bright green cushion plants near the summit of Mt. Wellington at approximately 1200 m, within 30 km of the center of the city of Hobart.

*Drosera arcturi* in Tasmania produces a horizontal rhizome measuring up to 15 cm long, at or just under the soil surface. From this descend many thin black roots with conspicuous root hairs. Additional growing points emerge from the rhizome over time. Each season three to five tough, almost succulent leaves are produced. The last two leaves produced each summer in January do not immediately grow to maturity but form a tight inverted conical bud which protects the apical meristem of the plant during winter. These leaves recommence growth in September and are non-carnivorous, lacking stalked retentive glands. This is especially visible in flowering individuals. From October to January three erect linear leaves are produced of which the second leaf is the longest. The leaves of *D. arcturi* are folded along their length and grow by simple elongation, opening flat as they mature; a growth pattern with some similarities to that of *D. burmannii* and tuberous rosetted *Drosera*

except that the leaves lie flat on the ground. They retain a furrowed base which may protect the younger leaves from cold weather during the growing season. The leaves lack a raised midrib, and the retentive glands held on long mobile stalks are restricted to the upper surface of the lamina.

In November a single scape emerges from the base of the first new leaf of the season. They grow directly up by stem elongation in a similar way to *D. binata* and *D. regia*, and reach up to 20 cm tall. The scape may have one small linear bract. One to three flowers are produced which open for a few days each in January. The flowers have white petals as long as 1.2 cm long (Figure 2). The petals surround an ovate green ovary, topped by three or four short white styles which are surrounded by five white stamens which produce yellow pollen. The extent of flower opening depends more upon air temperature than light levels. My last visit to a site on the west coast of Tasmania coincided with a period of hot weather (35°C) during which the *D. arcturi* flowers were fully open with horizontally held petals and sepals. They only began to close a little at dusk. Under other circumstances I have seen flowers which were only open enough to expose the styles and tip of the stamens. With the flowers fully open I observed that the anthers are held at the same height as the styles and that from the distribution of orange pollen on the styles most flowers appeared to have self-pollinated. During the summer the air temperatures are generally cool and the flowers only expose the styles and anthers. From the arrangement of the flowering parts it appears the pollination syndrome employed by this species utilizes flying insects landing on the styles, and subsequently contacting the stamens.

The seed is black, smooth, pyriform and up to 2 mm long; and is almost identical to that of *Dionaea muscipula*. It is shed from the top of the ripe fruit in March and requires exposure to cold weather before germinating the following spring.

*Drosera arcturi* is a slow grower. Each year mature plants produce approximately 1 cm of rhizome. It grows in a range of soils, including sedge peat, *Sphagnum* moss, cushion plant and coarse quartzite gravel. The *D. arcturi* rhizome is generally above ground when growing in gravel, but is shallowly buried in the softer, organic substrates. Periodic fires may also burn the upper surface of the peaty soil, killing many plants. Those plants growing on the surface of gravelly soils usually escape being burnt.

Much time and patience would be needed to grow this species to maturity. For example, a seedling approximately two years old was found at one site in early 1997. It had only two leaves, 4 mm long by 2 mm wide. In view of the climate of the south west of Tasmania this species may be grown most easily in western Europe and the north west coast of the USA and adjacent British Columbia.

The size of leaves and number of flowers produced by *D. arcturi* plants are variable and the larger plants grow in the southwest part of the island state. A reason for this may be due to the temperature ranges during the growing season. Cool minimum temperatures, including light frosts, occur year round on the central plateau. In contrast, warmer minimum temperatures occur on lower elevations in the southwest. In these regions cool moist winds of the "Roaring Forties" flow over the land, so the climate is humid, cloudy, with high average annual rainfall. Cultivation experiments combined with weather data from a number of sites would be useful in quantifying the influence of climate on the size of plants from around the state.

#### *Drosera regia* in the wild

In July 1997 I visited the principal site of *Drosera regia* in South Africa, observing the conditions in which it grows in the wild. These supplement observations on

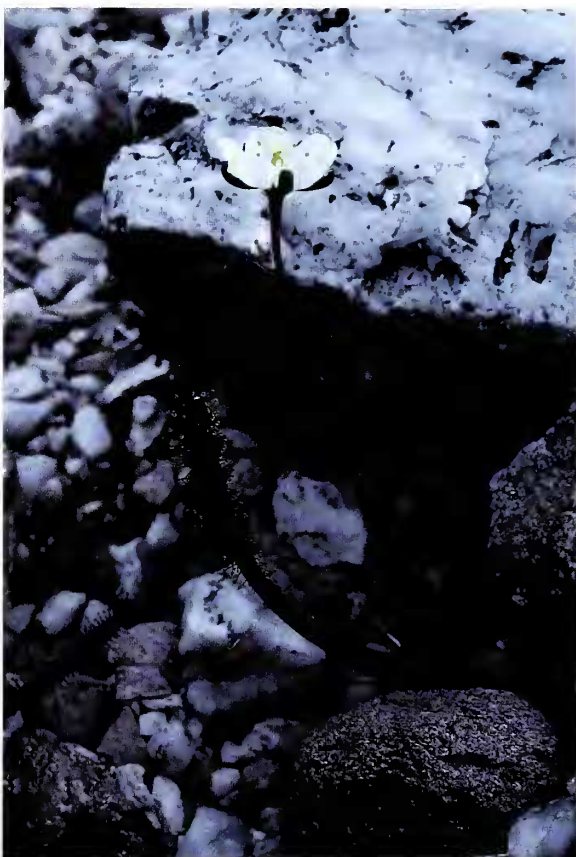


Figure 1: *Drosera arcturi* from Tasmania.



Figure 2: Three open flowers of *Drosera arcturi*. Note that the central flower has six petals and that these flowers have an extra stamen.

plants in cultivation. *Drosera regia* is known from a single valley in the Baviaanskloof in permanently damp soil (Stephens, 1926). The site visited (the lower of two) is a gravel bench on the floor of poorly formed creek bed. Water flows from an area under a quartzite knoll, possibly from a soak. From the steep valley slopes rockfalls and landslides have shed a mantle of angular cobbles and boulders over the valley floor. The frequency of mass movement appears to have declined in the valley—no recent landslide scars or large rockfalls were evident. The soil contains a significant amount of sand and vein quartz gravel originating from granular diaggregation of quartzite, and a variable amount of peat.

The sundews grow in peaty sand, often along the edge of angular cobbles, and also in areas with a surface cover of gravel over moist peaty sand. When the plants grow in surface gravel, the rhizomes are below ground. When the plants grow in peaty sand soil, the rhizomes are above the surface amongst grasses and sedges. In mid-July the plants were emerging from dormancy. Seedlings and two plants in gravel had bedewed fully open leaves, the first of the season, whilst the rest of the plants had lengthening dormant buds. The plants were dormant and initially hard to find until the dead, black leaves and few dead scapes amongst grasses and sedges were recognized. The vegetation of this bench included a *Leucodendron* sp., and members of Cyperaceae, Iridaceae and Restionaceae.

#### Comparison of the robust *Drosera arcturi* variant with *D. regia*

Both *Drosera* species possess similar architectures, a horizontal woody rhizome from which a crown of erect linear leaves emerges. They grow in permanently moist, generally open conditions amongst herbs and low shrubs which are periodically burnt. Both species grow in the warmer months and form a tight winter bud of immature, modified leaves. Exposed rhizomes are killed by fire, however *D. regia* has the ability to resprout from any undamaged roots (Green, 1997). In both species the scapes grow vertically, lacking the circinate vernation developed in most other *Drosera*.

They differ in leaf growth pattern, number of flowers per scape, flower color, size and pollination strategy, leaf mobility, distribution and climatic zone. In *D. regia* the leaves are folded along their length but also grow by circinate vernation; uncurling as they grow. The undersurface of the leaf blade (but not either side of the conspicuous midrib) and the sepals and bracts of the inflorescence are covered in small sessile red retentive glands. Both the leaf blade and the stalked retentive glands are capable of folding over prey. The scapes have two primary branches bearing a total of five to twenty flowers, which have large pink unscented petals, 2 to 3 cm long (see Back Cover). The ovary is surmounted by three unbranched spreading styles, and is surrounded by five erect stamens which describe a smaller circular area than the styles. The arrangement of the stigmas and anthers minimizes the chance of self-pollination and experiments have shown that the pollen is compatible only with genetically different plants (Green, 1997). Frost occurs infrequently in Baviaanskloof. Many of the important similarities and differences of *D. arcturi* and *D. regia* are summarized in Table 1.

In the initial description of *Drosera regia*, Stephens (1926) placed this species in section Psychophila, which was then comprised of *D. arcturi*, *D. stenopetala* and *D. uniflora*, although she noted that the multiflowered scape was atypical for this group. Since then both *Drosera arcturi* and *D. regia* have been placed in their own

sections, *Arcturia* and *Regiae* respectively (Seine and Barthlott, 1994). Whilst *D. regia* is separated from all other members of the genus by its operculate pollen, of all the other members of the genus it is most similar in morphology, growth habit and pattern and, presumably, antiquity, to *D. arcturi*, especially the robust form from Tasmania in which many common features are readily observable.

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Table 1

| Feature                             | <i>Drosera arcturi</i>  | <i>Drosera regia</i>   |
|-------------------------------------|---|--|
| Leaf size and shape                 | Linear, to 25 cm × 1 cm.  | Linear, to 60 cm × 2 cm.   |
| Leaf Vernation                      | Grows straight.   | Weakly circinate vernation.  |
| Stipules and petiole                | Absent.   | Absent.  |
| Growing season                      | October to February.  | October to April or year-round (variable).   |
| Scape growth                        | Straight up, uncurled.  | Straight up, uncurled.   |
| Flowering                           | January.  | January.   |
| Flowers                             | 1 to 3, white with anthers extending beyond the styles, can self-pollinate. | 10 to 30, pink, with flat styles extending beyond the stamens, cannot self-pollinate, not self-compatible. |
| Styles                              | 3 or 4 undivided.   | 3-undivided.   |
| Seeds                               | Pyriform, black, shiny to 2 mm long by 1 mm diameter.                       | Linear, ornamented, to 2 mm long by 0.5 mm diameter.   |
| Woody Rhizome                       | Present.  | Present.   |
| Dormant bud                         | Tight vertical inverted cone of two immature leaves.                        | Tight cluster of short, immature leaves.   |
| Root system                         | Many thin black roots with root hairs on the entire length.                 | Few thick, fleshy roots with root hairs on the terminal 15 cm.   |
| Asexual reproduction                | Gradually branching rhizome.  | Infrequently branching rhizome, especially after flowering; and from the roots.                            |
| Glands beyond lamina upper surface? | None.   | Sessile glands on lamina undersurface and stipules.  |
| Distribution                        | Tasmania 0—1400m elevation.   | South Africa, in a valley northeast of Cape Town, 500—900 m.   |

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